

Wood Workability

SO WHAT IS WORKABILITY?

Workability



Wood Workability

- ▶ Characteristics
 - ▶ Movement : how much wood shrink or moves
 - ▶ Color : how natural wood colors age with time
 - ▶ Suitability: how does the wood perform given the project
 - ▶ Hardness: how easily can the wood be dented
 - ▶ Machinability: how easy is it to cut, plane and sand
 - ▶ Glue-Up: how strong is a glue bond and are special steps needed
 - ▶ Finishing: how easy does finish hold on the wood.
 - ▶ Price: Domestic and Exotic

What Affects Wood Stability?

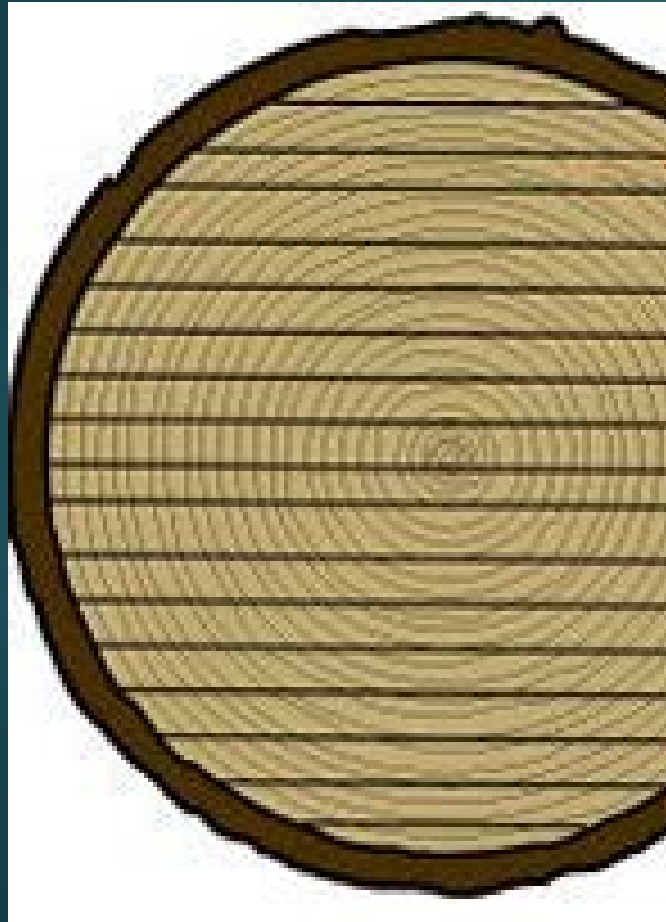
There are 3 different cuts of lumber that comes out of a log:

- ▶ quarter sawn,
- ▶ flat sawn and
- ▶ rift sawn.

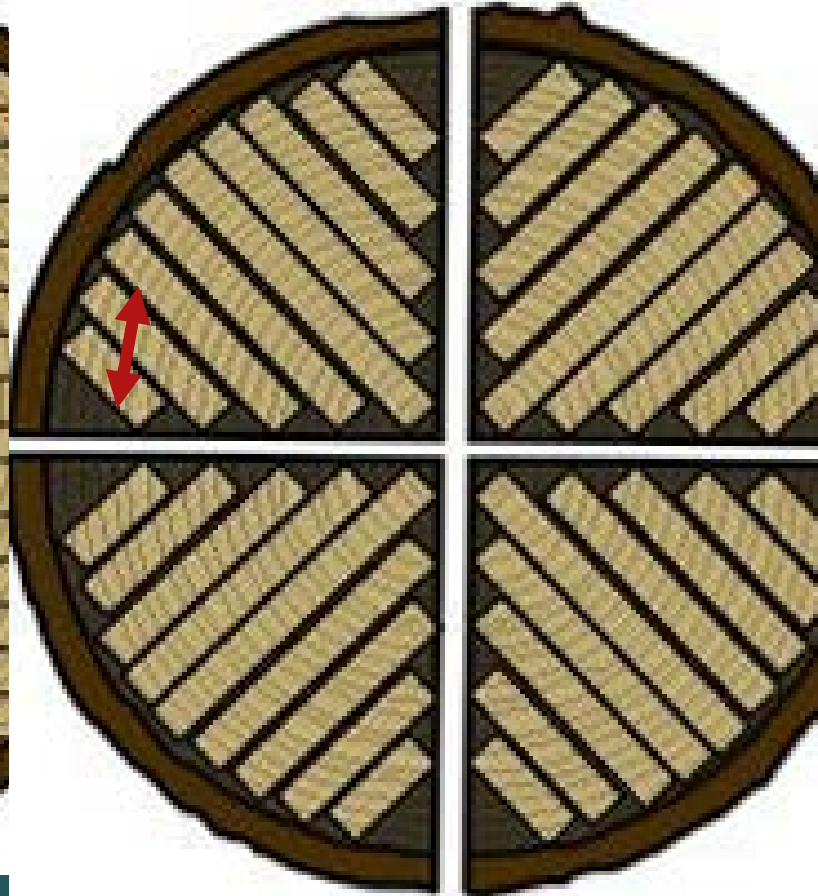
Each type of cut greatly affects the stability of the wood along with other workability advantages

3 Cuts of Lumber from a Log

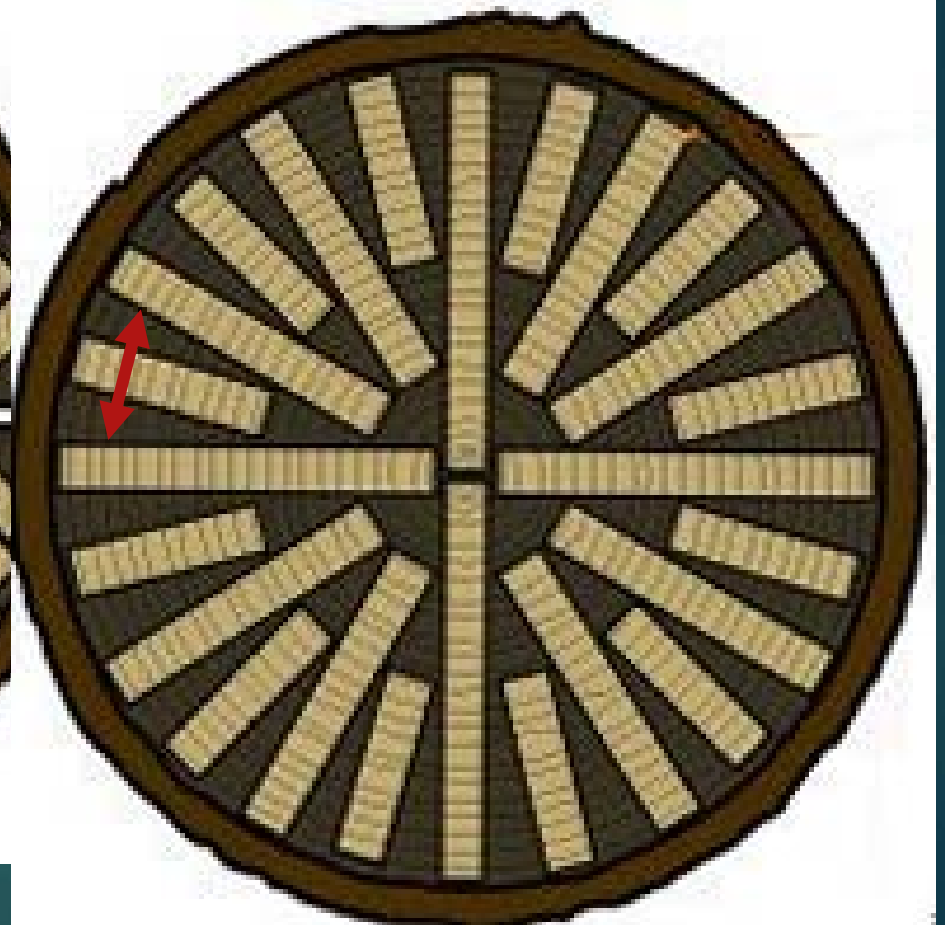
Plain or Flat



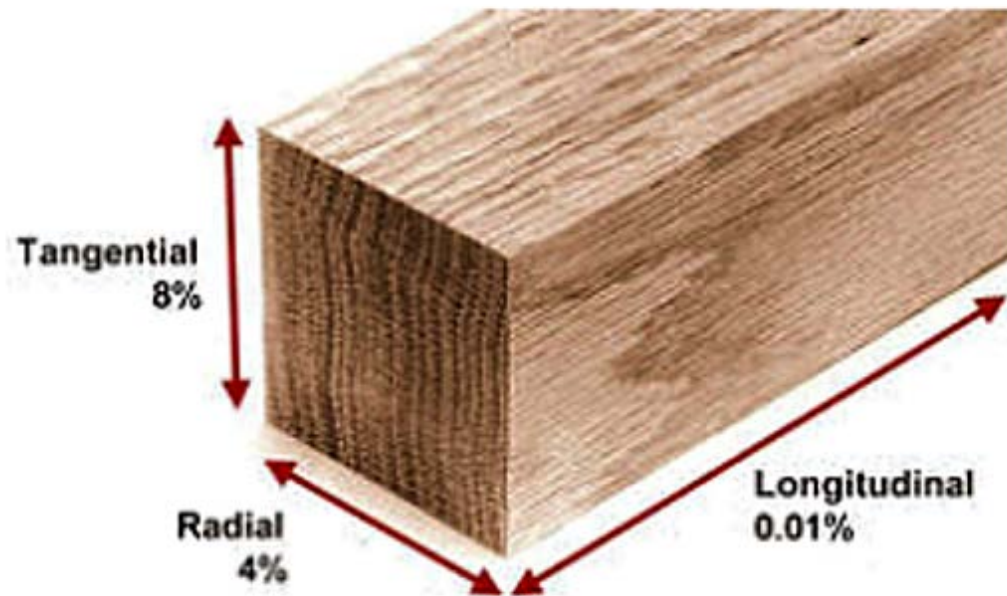
Quarter



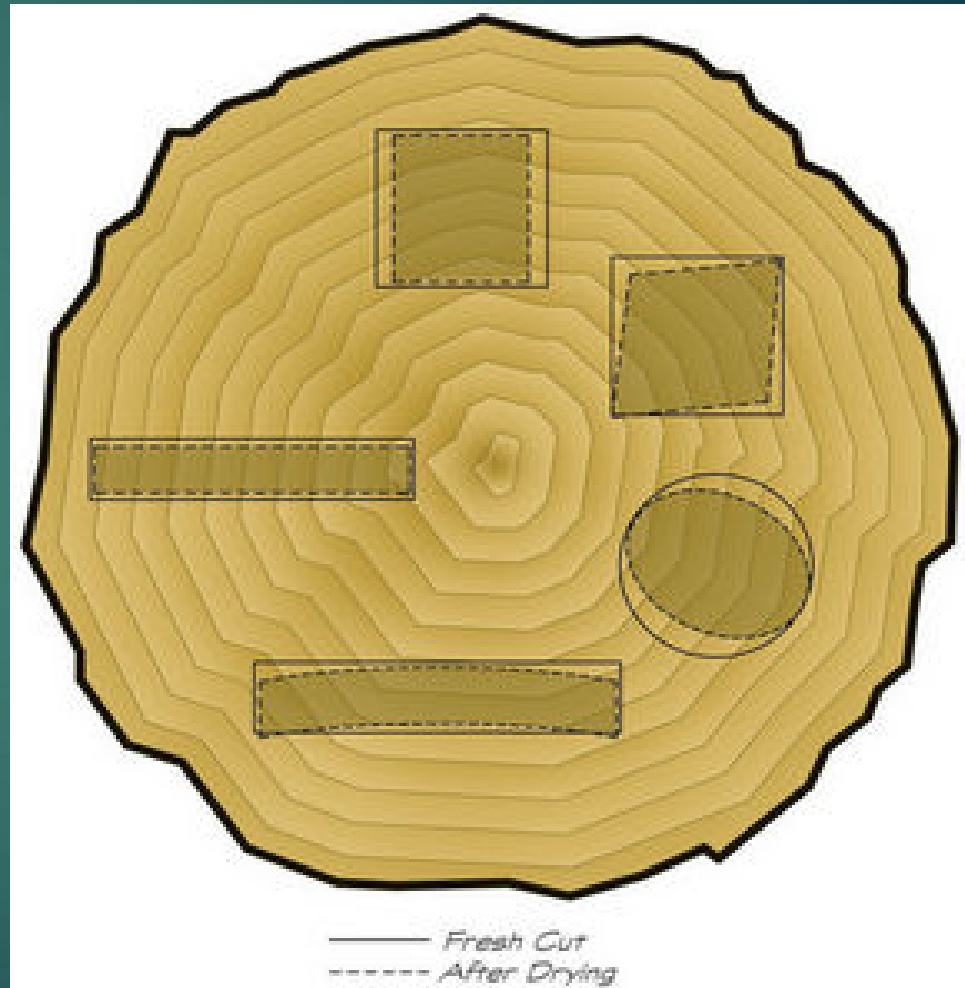
Rift



Understanding Wood Movement

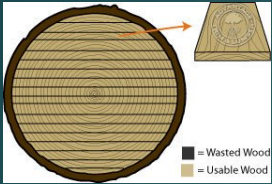


Wood is fairly stable along its length, moving only 0.01 percent as it loses its bound water. However, (on the average) it moves 8 percent tangentially and 4 percent radially.



3 Cuts of Lumber from a Log

Flat or Plain Sawn



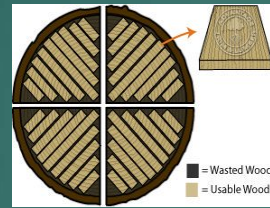
Advantages:

- Lower Cost
- Simplest to cut
- Less waste

Disadvantage:

- Cups, twists & bows
- Unwanted movement

Quarter Sawn

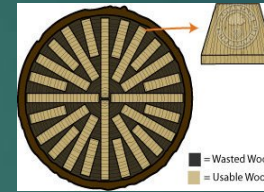


Advantages:

- Smoother surface
- Decreased expansion and contraction
- Twisting, cupping, and warping resistance
- More resistant to moisture penetration
- Enhanced paint retention

Disadvantage: Cost

Rift Sawn



Advantages:

- Same as Quarter Sawn
- Stability superior to Qtr Sawn
- Highlights rays and flecks

Disadvantage:

- Lots of waste
- Higher cost

Quarter Sawn Wood - Ray Flecks



Wood Movement

Chart Shows movement for Woods

- ▶ 1% change in moisture content
- ▶ For each tangential " of wood

Example

- ▶ Moisture goes from 6% to 16%
- ▶ 8" section of wood
- ▶ White Oak Movement= $(16\% - 6\%) \times 8" \times .0037 = .296"$ or about $5/16"$

SPECIES	QUARTERSAWN	FLATSAWN
Alder (Red)	.0015	.0026
Ash (White)	.0017	.0027
Aspen (Quaking)	.0012	.0023
Basswood (American)	.0023	.0033
Beech (American)	.0019	.0043
Birch (Yellow)	.0026	.0034
Butternut	.0012	.0022
Cherry (Black)	.0013	.0025
Fir (Balsam)	.0001	.0024
Mahogany	.0017	.0024
Maple (Red)	.0014	.0029
Maple (Sugar)	.0017	.0035
Oak (Red)	.0016	.0037
Oak (White)	.0018	.0037
Pine (Eastern White)	.0007	.0021
Pine (Longleaf)	.0018	.0026
Pine (Ponderosa)	.0013	.0022
Pine (Sugar)	.0010	.0019
Poplar (Yellow)	.0016	.0029
Sweetgum	.0018	.0037
Sycamore (American)	.0017	.0030
Teak	.0010	.0019
Walnut (Black)	.0019	.0027

Coping with Wood Movement

The tendency of wood to contract and expand cannot be stopped. You must plan for it!

- ▶ **Design** for wood movement.
- ▶ Let lumber **acclimate** to the environment in which it will be used.
- ▶ Consider **plywood**. Plywood is stable; it does not expand and contract like solid wood.
- ▶ Plan the **joinery** to avoid cross-grain assemblies.
- ▶ Attach tops with Figure 8 **connectors**, Z clips, shop made blocks or elongated screw holes.
- ▶ When fitting doors or drawers **build to the normal humidity in your area**. Low humidity allow a reveal the width of a nickel. Conversely, high humidity allow for a dime reveal.
- ▶ Use a **sliding dovetail** to apply molding across the grain. Glue only the first 2-3".
- ▶ Use **elongated holes** for screws. Glue and screw only the front few inches.
- ▶ Use "frame and panel" construction with a **small spot of glue** in the center of the width.
- ▶ Apply an equal number of **finish coats to ALL surfaces** to equalize the loss or gain of moisture.

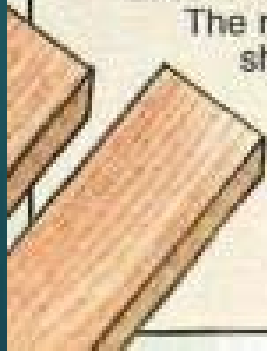
Coping with Wood Movement

Laboratory tests show finish effectiveness in keeping moisture out

Testing by the U.S. Forest Products Laboratory in Madison, Wisconsin, compared the moisture-excluding effectiveness of different types of finishes. Tests were conducted on dry Ponderosa pine boards that were coated, then exposed to the moisture vapor of 90 percent humidity at 80° F for from 1–14 days.

The results listed here show how only the most common woodworking finishes of the many tested performed.

FINISH TYPE	NO. OF COATS	% OF MOISTURE-EXCLUDING EFFECTIVENESS		
		1 day	7 days	14 days
Tung Oil	2	46	2	0
Lacquer	2	70	22	8
Shellac	2	84	43	20
Spar Varnish	2	80	36	15
Urethane Varnish	2	83	43	23
Gloss Enamel Paint	2	91	64	43
Polyurethane Varnish	2	90	66	46
Two-Part Epoxy	2	98	93	88



Color Stability

Wood	Colorfast rating	Comments
RED		
Bloodwood	2	Turns a very deep reddish brown—almost black.
Chakte Kok	1	Turns brown fast, but doesn't darken.
Jarrah	2	Initial color isn't quite red, and settled color isn't great either.
Tulipwood	3	Colors desaturate and shift toward brown, but maintains contrast.
Cocobolo	2	Colors can darken to nearly black, sometimes contrast is maintained.
ORANGE		
Padauk	2	Turns a very deep reddish brown (lighter pieces turn brownish gray).
Brazilwood	3	Initial color isn't always great, but retains colors slightly better.
Chakte Viga	3	Initial color isn't always great, but retains colors slightly better.
Buckthorn	3	Starts pinkish orange, slight shift toward brown.
Canarywood	3	Colors tend to desaturate to shades of brown, still maintains contrasts.
YELLOW		
Osage Orange	1	Drastic changes toward dark brown inevitable.
Tatajuba	1	Not great color to start with, not great color to end with.
Yellowheart	4	Retains color fairly well, though some browning occurs.

Color Stability

GREEN

Lignum Vitae	2	Darker pieces can turn nearly black.
Verawood	4	Retains olive color well, may actually increase in coloration over time.
Sumac	3	Colors desaturate to a more neutral olive-brown.
Pistachio	3	Colors desaturate to a more neutral olive-brown.

BLUE

Blue Mahoe	3	This wood is not blue, it's a cool gray at best. Dyes give a true blue.
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PURPLE

Purpleheart	2	Gives a good run for a while, but inevitably turns brown/black.
Bois de Rose	1	This wood is the worst. Expensive, endangered, and turns <i>really</i> black .
Katalox	3	Already nearly black, it is more suited for black than purple.
Kingwood	3	Starts a reddish purple, shifts toward brown/black. Maintains contrasts.

PINK

Pink Ivory	1	Turns brown fast, but doesn't darken.
Tasmanian Myrtle	3	Initial color isn't the best, but only slight shift toward brown.
Box Elder	2	Much of the color fades to brown.

BLACK

African Ebony	5	Starts black, stays black.
Wenge	3	Starts very dark, can actually lighten over time.
Panga Panga	3	Starts very dark, can actually lighten over time.
African Blackwood	5	Starts black, stays black.

Dealing with Color Change

Almost all natural color will change over time...but you can help (a little)

- ▶ Some woods hold color better than others (previous chart)
- ▶ If you really want color to last, use dyes! To get color throughout a board (max ½" thick), boil it in lye for about 8 hours, changing the solution every 3-4 hours. This breaks down the tannins in the wood, allow the color to penetrate
- ▶ Be sure to use several coats of finish to block out as much air/vapor as possible. Studies have shown that the more coats of finish that are used, the less the wood is effected by changes in humidity. Using a simple rub-in oil finish or paste wax offers very little resistance for the wood; you're after a film-building finish.
- ▶ Keep the wood out of direct sunlight, and try to avoid placing it in areas of high light. (UV light tends to shift the color of certain woods.)
- ▶ As an extra precaution, you can use an exterior-grade spar varnish with UV inhibitors.
- ▶ If you are trying to maintain the color of a light-colored wood, such as [Maple](#) or [Holly](#), use a water-based finish, or a finish that doesn't yellow with age.

Suitability for Outdoors

Good for Outdoor Use

Good for Indoor not Outdoor Use

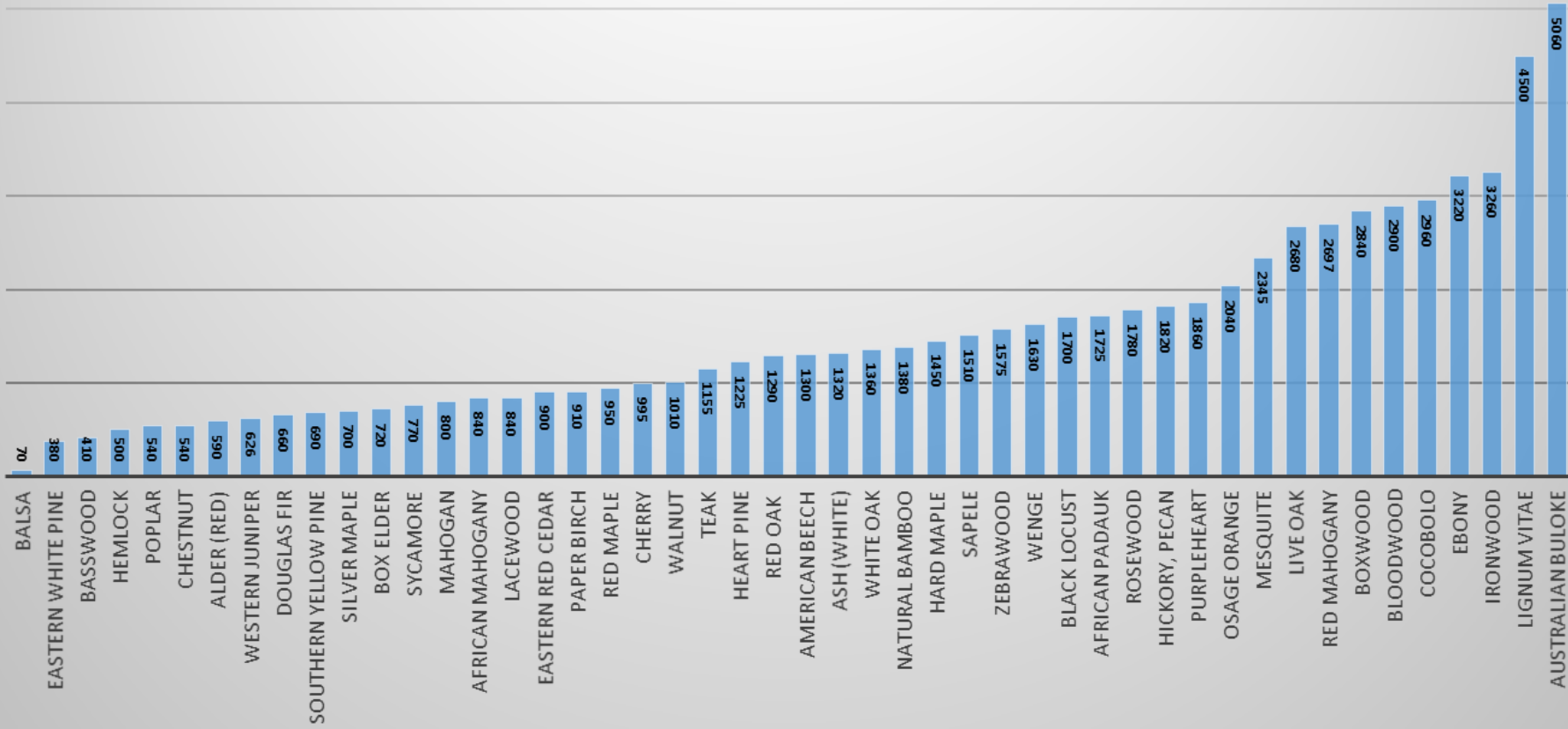
Performance and obtainability		Rank	Wood Species	Price Guide (1 Low - 7 Very Expensive)
Very Durable and hardwearing	Not easily obtainable	1	Greenheart	5
		2	Balau	5
		3	Teak	7
	Easy to obtain	4	Iroko	2
		5	Accoya	4
		6	Green Oak	3
		7	Seasoned Oak	3
		8	European Oak - Prime S/E	3
		9	Utile	2

Durable		10	Larch	2
		11	Idigbo	2
		12	Western Red Cedar*	2

Performance and obtainability		Rank	Wood Species	Price Guide (1 Low - 7 Very Expensive)
Hardwearing but non-durable	Easy to obtain	13	American White Oak	3
		14	American Maple	3
		15	Steamed Beech	2
		16	European Beech S/E	2
		17	American White Ash	2
		18	Southern Yellow Pine	1
		19	American Black Walnut	4
		20	Sapele	2
		21	American Cherry	3
		22	Dark Red Meranti	2
		23	Douglas Fir**	2
		Strong but not hardwearing or durable		24
25	Scandinavian redwood			1

Suitability for Hardness or Softness

Janka Hardness for Wood Wearability & Resistance to Dent



Gluing: Problem Woods

Many tropical hardwoods are so oily they're practically waterproof. If a wood glue needs to penetrate into the wood in order to obtain a strong bond, then these oily woods would present a challenge in gluing.

Solution:

- ▶ Wipe the wood surface with a solvent prior to gluing.
- ▶ Sand the wood to help open up the grain
- ▶ Use synthetic, non-water-based glues (Gorilla, CA, Epoxy)

Known problematic woods

Bubinga	Katalox
Bulletwood	Kingwood
Cocobolo	Lignum Vitae
Cumaru	Osage Orange
Ebonies	Purpleheart
Ekki	Rosewoods
Goncalo Alves	Teak
Greenheart	Verawood
Ipe	

Finishing: Exotic Hardwoods

Many trees in tropical climates have unique chemical compositions many of which are readily soluble in various solvents found in finishing agents.

Oil-based finishes, such as polyurethane, are *reactive finishes* that undergo a chemical *reaction* as the solvent in the finish evaporates—ultimately causing the finish to cure and harden. The problem occurs as compounds in the wood prevent the finish from curing so it remains tacky indefinitely.

Solution: Use Shellac as a sealer/wash coat...it *sticks to everything, and everything sticks to it.*

Known problematic woods

Blackwood	Kingwood
Bloodwood	Lignum Vitae
Bocote	Macacauba
Cedar	Padauk
Cocobolo	Pau Ferro
Cumaru	Purpleheart
Ebony	Rosewoods
Goncalo Alves	Teak
Ipe	Tulipwood
Katalox	Verawood

Machinability ···Glue-Up···Finishing

Wood	Strength		Tangential Stability		Hand Tools		Power Tools		Gluing		Hardness		Bendability		Finishing	
	Strong	Weak	High	Low	Easy	Difficult	Easy	Difficult	Good	Poor	Low	High	Low	High	Exell.	Poor
Alder	Weak		7.3		Difficult		Difficult		Good		Very Soft		Low		Good	
Ash	Strong		7.8		Very Easy		Moderate		Excellent		Hard		Very High		Excellent	
Aspen	Very Weak		6.7		Very Easy		Easy		Good		Very Soft		Low		Poor	
Basswood	Weak		9.3		Very Easy		Easy		Excellent		Very Soft		Very Low		Excellent	
Beach	Strong		11.9		Easy		Easy		Excellent		Hard		Very High		Excellent	
Birch	Very Strong		6.1		Easy		Moderate		Good		Hard		High		Excellent	
Cherry	Medium		7.1		Very Easy		Easy		Excellent		Medium		High		Excellent	
Elm	Medium		9.5		Difficult		Difficult		Fair		Soft		Very High		Fair	
Gum	Strong		10.2		Difficult		Easy		Excellent		Medium		Very Low		Excellent	
Hickory	Very Strong		10.2		Very Difficult		Difficult		Fair		Very Hard		Very High		Excellent	
Holly	Strong		9.9		Very Easy		Very Easy		Excellent		Hard		Low		Excellent	
Maple-Hard	Very Strong		9.3		Difficult		Easy		Excellent		Hard		Very High		Excellent	
Maple-Soft	Strong		8.2		Difficult		Easy		Good		Medium		High		Excellent	
Oak-Red	Strong		8.9		Easy		Easy		Good		Very Hard		High		Excellent	
Oak-White	Very Strong		10.5		Easy		Easy		Good		Very Hard		Very High		Good	
Osage Orange	Strong		0		Difficult		Moderate		Fair		Very Hard		Medium		Good	
Poplar	Medium		8.2		Very Easy		Very Easy		Excellent		Soft		Very Low		Good	
Sassafras	Weak		6.2		Easy		Very Easy		Excellent		Soft		Medium		Good	
Sycamore	Medium		8.4		Difficult		Difficult		Excellent		Soft		High		Good	
Walnut	Strong		7.8		Very Easy		Very Easy		Good		Medium		High		Excellent	

Wood Prices – (From Advantage Lumber.com)



Wood Prices – (From Advantage Lumber.com)





Figured Wood

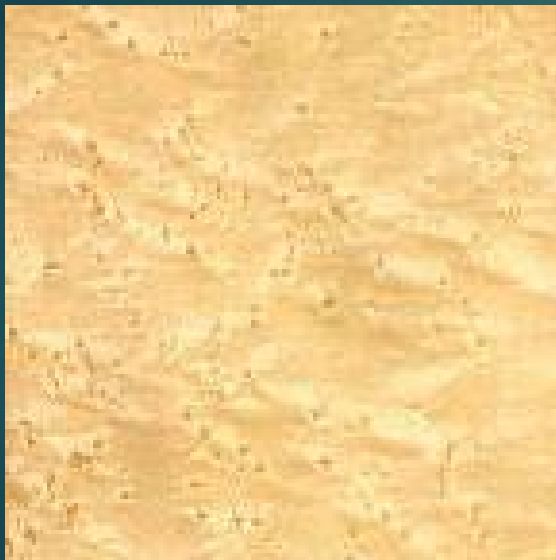
Terms with Examples

Figured Wood



Figured Wood Terms & Examples

Bird's Eye



Burl



Tiger
Fiddle Back
Curly



Quilted



Figured Wood Terms & Examples

Crotch



Ambrosia



Swirl

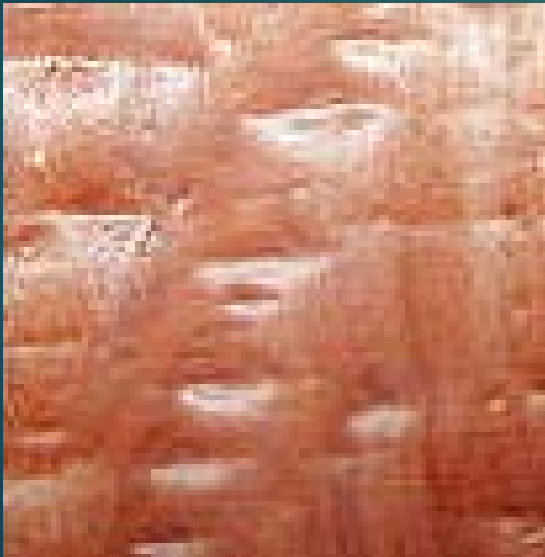


Cat's Paw



Figured Wood Terms & Examples

Blister



Bearclaw



Feather



Bee's Wing



Figured Wood Terms & Examples

Mottled



Razor Mottled



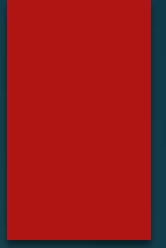
Angel Step



Pommelle



Results: Wood Identification



Results: Wood Identification

1. Ash



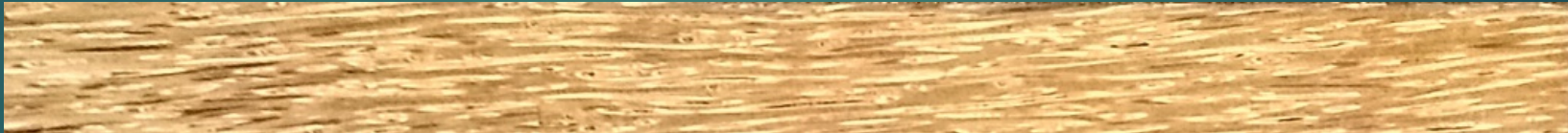
Results: Wood Identification

1. Ash
2. Bamboo



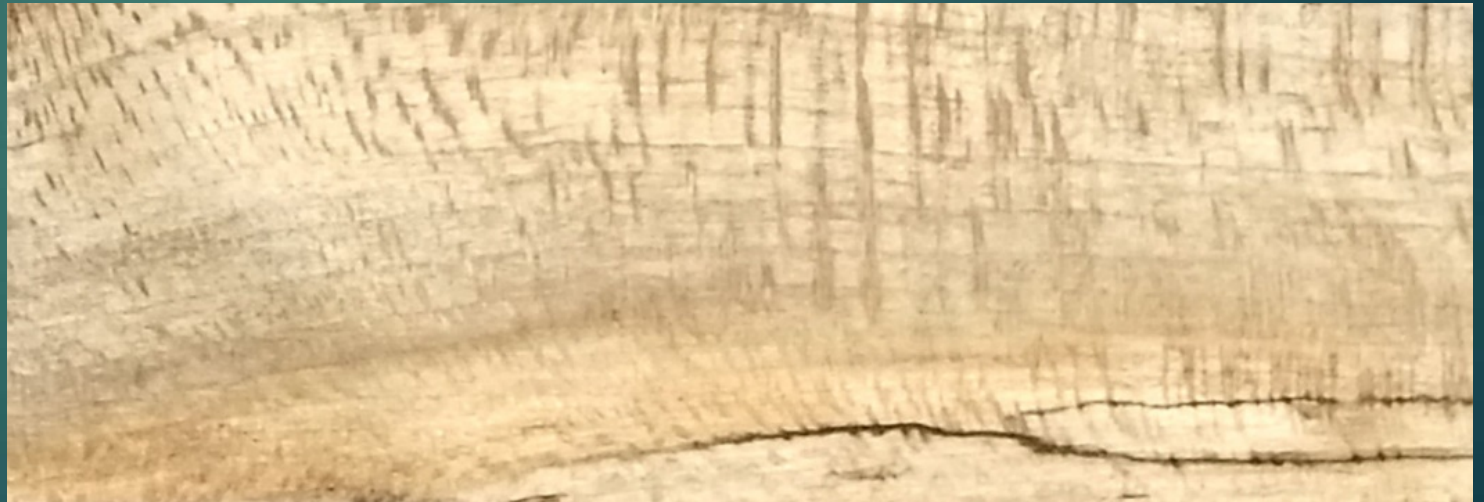
Results: Wood Identification

1. Ash
2. Bamboo
3. Palm



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk
6. Sapelle



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk
6. Sapelle
7. Canarywood



Results: Wood Identification

1. Ash

2. Bamboo

3. Palm

4. Sycamore

5. Paduk

6. Sapelle

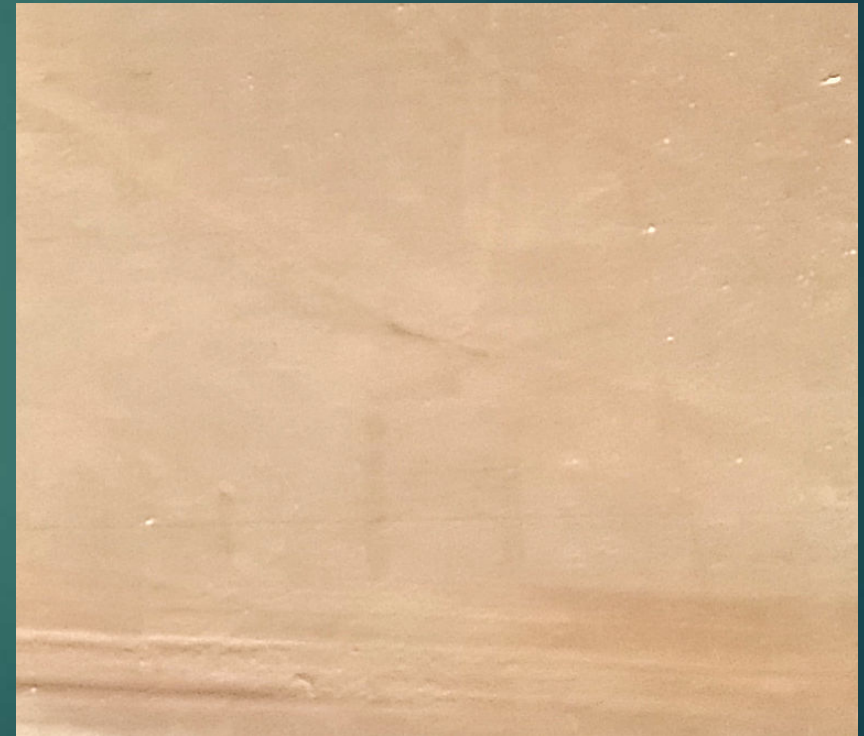
7. Canarywood

8. Elm



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk
6. Sapelle
7. Canarywood
8. Elm
9. Cherry



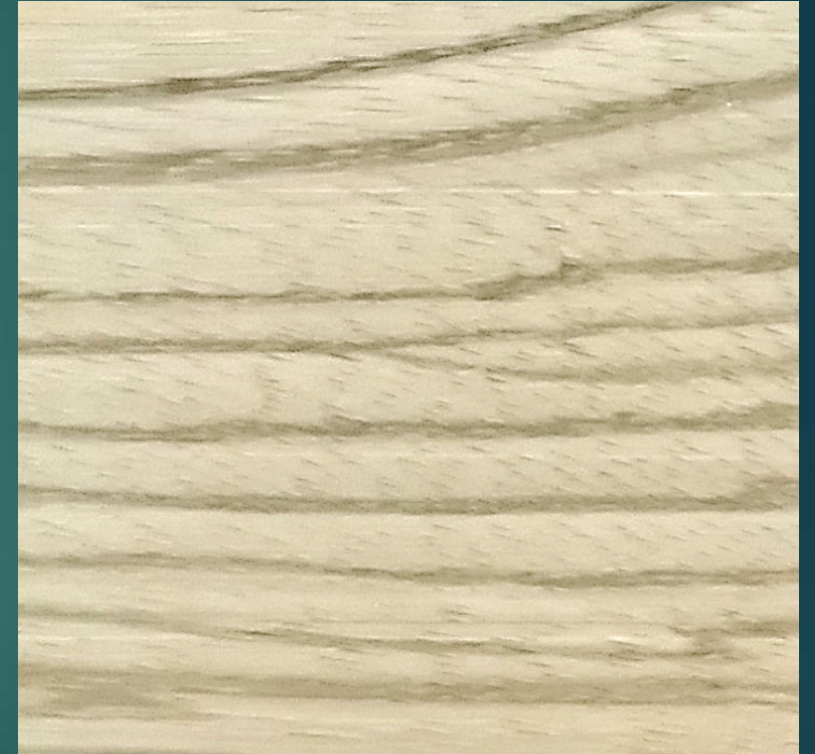
Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk
6. Sapelle
7. Canarywood
8. Elm
9. Cherry
10. Locust



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk
6. Sapelle
7. Canarywood
8. Elm
9. Cherry
10. Locust
11. Marblewood



Results: Wood Identification

1. Ash

2. Bamboo

3. Palm

4. Sycamore

5. Paduk

6. Sapelle

7. Canarywood

8. Elm

9. Cherry

10. Locust

11. Marblewood

12. Cocobolo



Results: Wood Identification

1. Ash
2. Bamboo
3. Palm
4. Sycamore
5. Paduk
6. Sapelle
7. Canarywood
8. Elm
9. Cherry
10. Locust
11. Marblewood
12. Cocobolo
13. Wenge



Results: Wood Identification

- | | |
|---------------|----------------|
| 1. Ash | 8. Elm |
| 2. Bamboo | 9. Cherry |
| 3. Palm | 10. Locust |
| 4. Sycamore | 11. Marblewood |
| 5. Paduk | 12. Cocobolo |
| 6. Sapelle | 13. Wenge |
| 7. Canarywood | 14. Box Elder |



Most of this information came from 1
website.....www.wood-database.com



THE WOOD DATABASE

General Wood Information

Are Rosewoods (and Bubinga)
really banned by CITES?

Common US Hardwoods

Ebony: Dark Outlook for Dark
Woods?

Restricted and Endangered Wood
Species

State Trees of the United States

The Ten Best Woods You've
Never Heard Of

Top Ten Most Overrated Woods

What is Wood?

Identifying Wood

The Truth Behind Wood
Identification

Wood Identification Guide

Hardwood Anatomy

Separating Specific Woods

Ash Wood: Black, White, and
Everything in Between

Distinguishing Red Oak from
White Oak

Differences Between Hard Maple
and Soft Maple

Distinguishing Brazilian Rosewood
from East Indian and Other
Rosewoods

Elm Wood: Hard and Soft

How to Tell Genuine Lignum Vitae
from Argentine Lignum Vitae

Mahogany Mixups: the Lowdown

Pine Wood: An Overall Guide


Poplar, Cottonwood, and Aspen:
What's What?

Separating Spruce and Other
Lookalikes

Sorting Out Satinwoods

True Hickory and Pecan Hickory

Most of this information came from 1 website.....www.wood-database.com

Wood Finder 

Looking for the old wood listing page? It's still **available here** (though the latest updates and newest wood profiles will only be added to this current page).

Scientific Name:

Wood Type:


- Hardwood (393)
- Softwood (81)
- Monocot (4)

Alphabet Filter: Any # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z


Sort By:

Tree Height (ft)

13 — 330



Abura
(*Mitragyna spp.*)



Afata
(*Cordia trichotoma*)

Most of this information came from 1 website.....www.wood-database.com

Canarywood



Canarywood (Centrolobium spp.)



View more images below

Common Name(s): Canarywood, Canary

Scientific Name: Centrolobium spp.

Distribution: South America (from Panama down to southern Brazil)

Tree Size: 65-100 ft (20-30 m) tall, 2-3 ft (.6-1.0 m) trunk diameter

Average Dried Weight: 52 lbs/ft³ (830 kg/m³)

Specific Gravity (Basic, 12% MC): .65, .83

Janka Hardness: 1,520 lb_f (6,750 N)

Modulus of Rupture: 19,080 lb_f/in² (131.6 MPa)

Elastic Modulus: 2,164,000 lb_f/in² (14.93 GPa)

Crushing Strength: 9,750 lb_f/in² (67.2 MPa)

Shrinkage: Radial: 2.4%, Tangential: 5.6%, Volumetric: 8.4%, T/R Ratio: 2.3

Color/Appearance: Heartwood color can vary a fair amount, from a pale yellow-orange to a darker reddish brown, usually with darker streaks throughout. Pale yellow sapwood is sharply demarcated from heartwood. Color tends to darken and homogenize with age: see the article [Preventing Color Changes in Exotic Woods](#) for more information.

Grain/Texture: Grain is typically straight, but can be irregular or wild on some pieces. Uniform fine to medium texture with good natural luster.

Endgrain: Diffuse-porous; large pores in no specific arrangement, few; solitary and radial multiples of 2-3; mineral/gum deposits occasionally present; growth rings indistinct; rays not visible without lens; parenchyma varies depending on species: can be vasicentric, aliform, and confluent.

Rot Resistance: Rated as very durable in regard to decay resistance, as well as being resistant to termite and marine borer attack.

Workability: Easy to work with both hand and machine tools, though some tearout can occur during planing on pieces with wild or irregular grain. Good dimensional stability. Turns, glues and finishes well.